

What Is Claimed Is:

1. An ApoA-I agonist comprising:

(i) a 15 to 29-residue peptide or peptide analogue which forms an amphipathic α -helix in the presence of lipids and which comprises the structural formula (I):

$Z_1-X_1-X_2-X_3-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-X_{12}-X_{13}-X_{14}-X_{15}-X_{16}-X_{17}-X_{18}-X_{19}-X_{20}-X_{21}-X_{22}-X_{23}-Z_2$

or a pharmaceutically acceptable salt thereof, wherein:

X_1 is Pro (P), Ala (A), Gly (G), Gln (Q), Asn (N), Asp (D) or D-Pro (p);

X_2 is an aliphatic residue;

X_3 is Leu (L) or Phe (F);

X_4 is an acidic residue;

X_5 is Leu (L) or Phe (F);

X_6 is Leu (L) or Phe (F);

X_7 is a hydrophilic residue;

X_8 is an acidic or a basic residue;

X_9 is Leu (L) or Gly (G);

X_{10} is Leu (L), Trp (W) or Gly (G);

X_{11} is a hydrophilic residue;

X_{12} is a hydrophilic residue;

X_{13} is Gly (G) or an aliphatic residue;

X_{14} is Leu (L), Trp (W), Gly (G) or Nal;

X_{15} is a hydrophilic residue;

X_{16} is a hydrophobic residue;

X_{17} is a hydrophobic residue;

X_{18} is Gln (Q), Asn (N) or a basic residue;

X_{19} is Gln (Q), Asn (N) or a basic residue;

X_{20} is a basic residue;

X_{21} is an aliphatic residue;

X_{22} is a basic residue;

X_{23} is absent or a basic residue;

Z_1 is H_2N- or $RC(O)NH-$;

Z_2 is $-C(O)NRR$, $-C(O)OR$ or $-C(O)OH$ or a salt thereof;

each R is independently $-H$, (C_1-C_6) alkyl, (C_1-C_6) alkenyl, (C_1-C_6) alkynyl, (C_5-C_{20}) aryl, (C_6-C_{26}) alkaryl, 5-20 membered heteroaryl, 6-26 membered alkheteroaryl or a 1 to 7-residue peptide or peptide analogue;

each " - " between residues X_n independently designates an amide linkage, a substituted amide linkage, an isostere of an amide or an amide mimetic; or

(ii) a deleted from of structural formula (I) in which at least one and up to eight of residues $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17}, X_{18}, X_{19}, X_{20}, X_{21}$ and X_{22} are deleted; or

(iii) an altered form of structural formula (I) in which at least one of residues $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16}, X_{17}, X_{18}, X_{19}, X_{20}, X_{21}, X_{22}$ or X_{23} is conservatively substituted with another residue.

2. The ApoA-I agonist of Claim 1 which exhibits at least about 38% LCAT-activation activity as compared with human ApoA-I.

3. The ApoA-I agonist of Claim 1 which is the altered form of structural formula (I).

4. The ApoA-I agonist of Claim 3 in which the hydrophobic residues are fixed according to structural formula (I) and at least one non-fixed residue is conservatively substituted with another residue.

5. The ApoA-I agonist of Claim 4 in which:

X_1 is Pro (P), D-Pro (p), Gly (G) or Ala (A);

X_2 is Ala (A), Leu (L) or Val (V);

X_3 is Leu (L) or Phe (F);

5
X₅ is Leu (L) or Phe (F);
X₆ is Leu (L) or Phe (F);
X₉ is Leu (L) or Gly (G);
X₁₀ is Leu (L), Trp (W) or Gly (G);
X₁₃ is Leu (L), Gly (G) or Aib;
X₁₄ is Leu, Nal, Trp (W) or Gly (G);
X₁₆ is Ala (A), Nal, Trp (W), Gly (G), Leu (L) or
Phe (F);

10
X₁₇ is Leu (L), Gly (G) or Nal;
X₂₁ is Leu (L); and
at least one of X₄, X₇, X₈, X₁₁, X₁₂, X₁₅, X₁₈, X₁₉, X₂₀, X₂₂
and X₂₃ is conservatively substituted with another residue.

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6. The ApoA-I agonist of Claim 3 in which the
hydrophilic residues are fixed according to structural
formula (I) and at least one non-fixed residue is
conservatively substituted with another residue.

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7. The ApoA-I agonist of Claim 6 in which:
X₄ is Asp (D) or Glu (E);
X₇ is Lys (K), Arg (R) or Orn;
X₈ is Asp (D) or Glu (E);
X₁₁ is Asn (N) or Gln (Q);
X₁₂ is Glu (E) or Asp (D);
X₁₅ is Asp (D) or Glu (E);
X₁₈ is Gln (Q), Asn (N), Lys (K) or Orn;
X₁₉ is Gln (Q), Asn (N), Lys (K) or Orn;
X₂₀ is Lys (K) or Orn;
X₂₂ is Lys (K) or Orn;
25
X₂₃ is absent or Lys (K); and
at least one of X₁, X₂, X₃, X₅, X₆, X₉, X₁₀, X₁₃, X₁₄, X₁₆, X₁₇
and X₂₁ is conservatively substituted with another residue.

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8. The ApoA-I agonist of Claim 7 in which X₃ is Leu (L)
or Phe (F), X₆ is Phe (F), X₉ is Leu (L) or Gly (G), X₁₀ is Leu
35 (L) or Trp (W) or Gly (G) and at least one of X₁, X₂, X₅, X₁₃,

X₁₄, X₁₆, X₁₇, and X₂₁ is conservatively substituted with another residue.

9. The ApoA-I agonist of Claim 5 or 7 in which the substituting residue is classified within the same sub-category as the substituted residue.

10. The ApoA-I agonist of Claim 1 which is the deleted form of structural formula (I).

11. The ApoA-I agonist of Claim 10 in which one helical turn of the peptide or peptide analogue is deleted.

12. The ApoA-I agonist of Claim 1 which is a 22-23 residue peptide or peptide analogue of structural formula (I).

13. The ApoA-I agonist of Claim 12 in which:
the "-" between residues designates -C(O)NH-;
Z₁ is H₂N-; and
Z₂ is -C(O)OH or a salt thereof.

14. The ApoA-I agonist of Claim 13, in which:
X₁ is Pro (P), Ala (A), Gly (G), Asn (N), Gln (Q),
Asp (D) or D-Pro (p);
X₂ is Ala (A), Val (V) or Leu (L);
X₃ is Leu (L) or Phe (F);
X₄ is Asp (D) or Glu (E);
X₅ is Leu (L) or Phe (F);
X₆ is Leu (L) or Phe (F);
X₇ is Lys (K), Arg (R) or Orn;
X₈ is Asp (D) or Glu (E);
X₉ is Leu (L) or Gly (G);
X₁₀ is Leu (L), Trp (W) or Gly (G);
X₁₁ is Asn (N) or Gln (Q);
X₁₂ is Glu (E) or Asp (D);

X₁₃ is Gly (G), Leu (L) or Aib;
X₁₄ is Leu (L), Nal, Trp (W) or Gly (G);
X₁₅ is Asp (D) or Glu (E);
X₁₆ is Ala (A), Nal, Trp (W), Leu (L), Phe (F) or

Gly (G);

X₁₇ is Gly (G), Leu (L) or Nal;
X₁₈ is Gln (Q), Asn (N), Lys (K) or Orn;
X₁₉ is Gln (Q), Asn (N), Lys (K) or Orn;
X₂₀ is Lys (K) or Orn;
X₂₁ is Leu (L);
X₂₂ is Lys (K) or Orn; and
X₂₃ is absent or Lys (K).

15. The ApoA-I agonist of Claim 14, in which X₂₃ is absent.

16. The ApoA-I agonist of Claim 13 or 14, in which one of X₁₈ or X₁₉ is Gln (Q) or Asn (N) and the other of X₁₈ or X₁₉ is Lys (K) or Orn.

17. The ApoA-I agonist of Claim 14 in which each of X₉, X₁₀, X₁₃, X₁₄, X₁₅ and X₁₇ is other than Gly (G).

18. The ApoA-I agonist of Claim 14 in which one of X₉, X₁₀, X₁₃, X₁₄, X₁₅ and X₁₇ is Gly (G) and the others are other than Gly (G).

19. The ApoA-I agonist of Claim 1 which is selected from the group consisting of:

peptide 1	PVLDLFRELLNELLEZLKQKLK	(SEQ ID NO:1)
peptide 2	GVLDLFRELLNELLEALKQKLKK	(SEQ ID NO:2)
peptide 3	PVLDLFRELLNELLEWLKQKLK	(SEQ ID NO:3)
peptide 4	PVLDLFRELLNELLEALKQKLK	(SEQ ID NO:4)
peptide 5	pVLDLFRELLNELLEALKQKLKK	(SEQ ID NO:5)
peptide 6	PVLDLFRELLNEXLEALKQKLK	(SEQ ID NO:6)

peptide 7	PVLDLKFELLNELLEALKQKCLK	(SEQ ID NO:7)
peptide 8	PVLDLFRELLNEGLEALKQKCLK	(SEQ ID NO:8)
peptide 9	PVLDLFRELLGNELLEALKQKCLK	(SEQ ID NO:9)
peptide 10	PVLDLFRELLNELLEAZKQKCLK	(SEQ ID NO:10)
peptide 11	PVLDLKFELLQELLEALKQKCLK	(SEQ ID NO:11)
peptide 12	PVLDLFRELLNELLEAGKQKCLK	(SEQ ID NO:12)
peptide 13	GVLDLFRELLNEGLEALKQKCLK	(SEQ ID NO:13)
peptide 14	PVLDLFRELLNELLEALOQOLO	(SEQ ID NO:14)
peptide 15	PVLDLFRELLWELLEALKQKCLK	(SEQ ID NO:15)
peptide 16	PVLDLLRELLNELLEALKQKCLK	(SEQ ID NO:16)
peptide 17	PVLELFKELLQELLEALKQKCLK	(SEQ ID NO:17)
peptide 18	GVLDLFRELLNELLEALKQKCLK	(SEQ ID NO:18)
peptide 19	PVLDLFRELLNEGLEALKQKCLK	(SEQ ID NO:19)
peptide 20	PVLDLFREGLNELLEALKQKCLK	(SEQ ID NO:20)
peptide 21	PVLDLFRELLNELLEALKQKCLK	(SEQ ID NO:21)
peptide 22	PVLDLFRELLNELLEGLKQKCLK	(SEQ ID NO:22)
peptide 23	PLLELFKELLQELLEALKQKCLK	(SEQ ID NO:23)
peptide 24	PVLDLFRELLNELLEALQKCLK	(SEQ ID NO:24)
peptide 25	PVLDFFRELLNEXLEALKQKCLK	(SEQ ID NO:25)
peptide 26	PVLDLFRELLNELLELLKQKCLK	(SEQ ID NO:26)
peptide 27	PVLDLFRELLNELZEALKQKCLK	(SEQ ID NO:27)
peptide 28	PVLDLFRELLNELWEALKQKCLK	(SEQ ID NO:28)
peptide 29	AVLDLFRELLNELLEALKQKCLK	(SEQ ID NO:29)
peptide 123	QVLDLFRELLNELLEALKQKCLK	(SEQ ID NO:123)
peptide 124	PVLDLFOELLNELLEALOQOLO	(SEQ ID NO:124)
peptide 125	NVLDLFRELLNELLEALKQKCLK	(SEQ ID NO:125)
peptide 126	PVLDLFRELLNELGEALKQKCLK	(SEQ ID NO:126)
peptide 127	PVLDLFRELLNELLELLKQKCLK	(SEQ ID NO:127)
peptide 128	PVLDLFRELLNELLEFLKQKCLK	(SEQ ID NO:128)
peptide 129	PVLELFNDLLRELLEALQKCLK	(SEQ ID NO:129)
peptide 130	PVLELFNDLLRELLEALKQKCLK	(SEQ ID NO:130)
peptide 131	PVLELFKELLNELLDALRQKCLK	(SEQ ID NO:131)
peptide 132	PVLDLFRELLNELLEALQKCLK	(SEQ ID NO:132)

peptide 133 PVLELFFERLLEDLLQALNKKLK (SEQ ID NO:133)
 peptide 134 PVLELFFERLLEDLLKALNQKLIK (SEQ ID NO:134)
 peptide 135 DVLDLFFRELLNELLEALKQKLIK (SEQ ID NO:135)
 peptide 136 PALELFFKDLLQELLEALKQKLIK (SEQ ID NO:136)
 peptide 137 PVLDLFFRELLNEGLEAZKQKLIK (SEQ ID NO:137)
 peptide 138 PVLDLFFRELLNEGLEWLKQKLIK (SEQ ID NO:138)
 peptide 139 PVLDLFFRELWNEGLEALKQKLIK (SEQ ID NO:139)
 peptide 140 PVLDLFFRELLNEGLEALOQOLO (SEQ ID NO:140)
 peptide 141 PVLDLFFRELLNEGLEALKQKLIK (SEQ ID NO:141)
 peptide 142 PVLELFFRELLNEGLEALKQKLIK (SEQ ID NO:142)

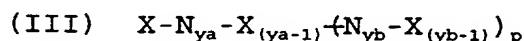
and the N-terminal acylated and/or C-terminal amidated or esterified forms thereof, wherein X is Aib; Z is Nal; and O is Orn.

20. A multimeric ApoA-I agonist which exhibits at least about 38% LCAT activation activity as compared with human ApoA-I and which has the structural formula (II):



or a pharmaceutically acceptable salt thereof, wherein:
 each m is independently an integer from 0 to 1;
 n is an integer from 0 to 10;
 each "HH" is independently a peptide or peptide analogue according to Claim 1;
 each "LL" is independently a bifunctional linker;
 and
 each " - " independently designates a covalent linkage.

21. A multimeric ApoA-I agonist which exhibits at least about 38% LCAT activation activity as compared with human ApoA-I and which has the structural formula (III):



each X is independently $\text{HH}(\text{LL}_m\text{--HH})_n\text{LL}_m\text{--HH}$;
each HH is independently a core peptide of
structure (I) or an analogue or mutated, truncated,
internally deleted or extended form thereof as described
herein;

N_{ya} and N_{yb} are each independently a multifunctional linking moiety where y_a and y_b represent the number of functional groups on N_{ya} and N_{yb} , respectively;

p is an integer from 0 to 7; and
each "-" independently designates a covalent bond.

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each X is independently $HH(LL_m-HH)_nLL_m-HH$;
each HH is independently a peptide or peptide
analogue according to Claim 1;
each LL is independently a bifunctional linker;
each n is independently an integer from 0 to 1;
each m is independently an integer from 0 to 8;
 R_1 is -OR or -NRR; and
each R is independently -H, (C_1-C_6) alkyl, (C_1-C_6)
alkenyl, (C_1-C_6) alkynyl; (C_5-C_{20}) aryl (C_6-C_{26}) alkaryl, 5-20
membered heteroaryl or 6-26 membered alkheteroaryl.

23. The multimeric ApoA-I agonist of Claim 20, 21 or 22
in which the bifunctional linker is cleavable.

24. The ApoA-I multimeric agonist of Claim 20, 21 or 22
in which n is 0.

25. The multimeric ApoA-I agonist of Claim 24 in which
m is 0.

26. The multimeric ApoA-I agonist of Claim 20, 21 or 22
in which each HH is independently a peptide according to
Claim 13.

27. The multimeric ApoA-I agonist of Claim 20, 21 or 22
in which each HH is independently a peptide according to
Claim 14.

28. The multimeric ApoA-I agonist of Claim 20, 21 or 22
in which each HH is independently a peptide according to
Claim 19.

29. An ApoA-I agonist-lipid complex comprising an
ApoA-I agonist and a lipid, wherein the ApoA-I agonist is a
peptide or peptide analogue according to Claim 1, a
multimeric ApoA-I agonist according to Claim 20, a multimeric

ApoA-I agonist according to Claim 21, or a multimeric ApoA-I agonist according to Claim 22.

30. The ApoA-I agonist-lipid complex of Claim 29 in which the ApoA-I agonist is a peptide according to Claim 12.

31. The ApoA-I agonist-lipid complex of Claim 29 in which the ApoA-I agonist is a peptide according to Claim 13.

32. The ApoA-I agonist-lipid complex of Claim 29 in which the ApoA-I agonist is a peptide according to Claim 14.

33. The ApoA-I agonist-lipid complex of Claim 29 in which the ApoA-I agonist is a peptide according to Claim 19.

34. The ApoA-I agonist-lipid complex of Claim 29 in which the lipid is sphingomyelin.

35. The ApoA-I agonist-lipid complex of Claim 29 which is in the form of a lyophilized powder.

36. The ApoA-I agonist-lipid complex of Claim 29 which is in the form of a solution.

37. A pharmaceutical composition comprising an ApoA-I agonist and a pharmaceutically acceptable carrier, excipient or diluent, wherein the ApoA-I agonist is a peptide or peptide analogue according to Claim 1, a multimeric ApoA-I agonist according to Claim 20, a multimeric ApoA-I agonist according to Claim 21, or a multimeric ApoA-I agonist according to Claim 22.

38. The pharmaceutical composition of Claim 37 in which the ApoA-I agonist is a peptide according to Claim 12.

39. The pharmaceutical composition of Claim 37 in which the ApoA-I agonist is a peptide according to Claim 13.

40. The pharmaceutical composition of Claim 37 in which the ApoA-I agonist is a peptide according to Claim 14.

41. The pharmaceutical composition of Claim 37 in which the ApoA-I agonist is a peptide according to Claim 19.

42. The pharmaceutical composition of Claim 37, 38, 39, 40 or 41, in which the ApoA-I agonist is in the form of an ApoA-I agonist-lipid complex, said complex comprising the ApoA-I agonist and a lipid.

43. The pharmaceutical composition of Claim 42 in which the ApoA-I agonist-lipid complex is in the form of a lyophilized powder.

44. A method of treating a subject suffering from a disorder associated with dyslipidemia, said method comprising the step of administering to the subject an effective amount of the ApoA-I agonist of Claim 1.

45. The method of Claim 44 in which the ApoA-I agonist is in the form of a pharmaceutical composition, said composition comprising the ApoA-I agonist and a pharmaceutically acceptable carrier, excipient or diluent.

46. The method of Claim 44 in which the ApoA-I agonist is in the form of an ApoA-I agonist-lipid complex, said complex comprising the ApoA-I agonist and a lipid.

47. The method of Claim 44 in which the disorder associated with dyslipidemia is hypercholesterolemia.

48. The method of Claim 44 in which the disorder associated with dyslipidemia is cardiovascular disease.

5 49. The method of Claim 44 in which the disorder associated with dyslipidemia is atherosclerosis.

50. The method of Claim 44 in which the disorder associated with dyslipidemia is restenosis.

10 51. The method of Claim 44, in which the disorder associated with dyslipidemia is HDL or ApoA-I deficiency.

5 52. The method of Claim 44, in which the disorder associated with dyslipidemia is hypertriglyceridemia.

53. The method of Claim 44, in which the disorder associated with dyslipidemia is metabolic syndrome.

20 54. A method of treating a subject suffering from septic shock, said method comprising the step of administering to the subject an effective amount of the ApoA-I agonist of Claim 1.

25 55. The method of Claim 44 or 54 in which said subject is a human.

56. The method of Claim 44 or 54 in which about 0.5 mg/kg to about 100 mg/kg ApoA-I agonist is administered to said subject.